

# THE LANCET

## Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed.  
We post it as supplied by the authors.

Supplement to: Hansen CH, Michlmayr D, Gubbels SM, Mølbak K, Ethelberg S.  
Assessment of protection against reinfection with SARS-CoV-2 among 4 million  
PCR-tested individuals in Denmark in 2020: a population-level observational  
study. *Lancet* 2021; published online March 17. [http://dx.doi.org/10.1016/S0140-6736\(21\)00575-4](http://dx.doi.org/10.1016/S0140-6736(21)00575-4).

**Supplementary materials**

**Contents**

Table S1. Characteristics of the people who died before the second surge. .... 2

Table S2. Number of tests per person during the second surge, among people tested in the first surge. .... 3

Table S3a. Model parameters for main analysis: Reinfection during the second surge. .... 4

Table S3b. Model parameters for the alternative cohort analysis..... 5

Figure S1. Time between testing ..... 6

Figure S2. Kaplan-Meier curves of the time until (re)infection during follow-up ..... 7

	Infected during first surge	Not infected during first surge
<b>Total tested during first surge</b>	11,727	521,044*
<b>Total deaths before 1 Sep, 2020</b>	659 (5.6%)	6773 (1.3)
<b>Age distribution among those who died</b>		
0-29 years	0 ( 0.0%)	32 ( 0.5%)
30-59 years	27 ( 4.1%)	520 ( 7.7%)
60-69 years	66 (10.0%)	934 (13.8%)
70-79 years	189 (28.7%)	2016 (29.8%)
80-89 years	250 (37.9%)	2232 (33.0%)
90+ years	127 (19.3%)	1039 (15.3%)

\*note 610 people who tested positive for the first time between the first and second surge of the epidemic have been removed.

**Table S1. Characteristics of the people who died before the second surge among those tested in the first surge.**

	Individuals infected during first surge					Individuals not infected during first surge				
	Total	Number of tests per person during second surge				Total	Number of tests per person during second surge			
		0	1	2-3	4+		0	1	2-3	4+
<b>Total</b>	11,068	3525 (32)	2426 (22)	2719 (25)	2398 (22)	514,271	124165 (24)	117711 (23)	154359 (30)	118036 (23)
<b>Positive test during second surge</b>										
<b>Overall</b>	72	0 (0)	7 (10)	26 (36)	39 (54)	16819	0 (0)	3019 (18)	7008 (42)	6792 (40)
<b>By sex</b>										
Women	46	0 (0)	4 ( 9)	13 (28)	29 (63)	10484	0 (0)	1586 (15)	4096 (39)	4802 (46)
Men	26	0 (0)	3 (12)	13 (50)	10 (38)	6335	0 (0)	1433 (23)	2912 (46)	1990 (31)
<b>By age</b>										
0-19 years	4	0 (0)	1 (25)	3 (75)	0 ( 0)	1881	0 (0)	411 (22)	891 (47)	579 (31)
20-34 years	15	0 (0)	0 ( 0)	5 (33)	10 (67)	4789	0 (0)	817 (17)	2058 (43)	1914 (40)
35-50 years	20	0 (0)	2 (10)	5 (25)	13 (65)	4358	0 (0)	685 (16)	1744 (40)	1929 (44)
50-64 years	16	0 (0)	1 ( 6)	6 (38)	9 (56)	3925	0 (0)	690 (18)	1567 (40)	1668 (42)
65-79 years	8	0 (0)	0 ( 0)	4 (50)	4 (50)	1255	0 (0)	298 (24)	540 (43)	417 (33)
80+ years	9	0 (0)	3 (33)	3 (33)	3 (33)	611	0 (0)	118 (19)	208 (34)	285 (47)
<b>Time of first test during second surge</b>										
September	36	0 (0)	1 ( 3)	10 (28)	25 (69)	7196	0 (0)	271 ( 4)	2556 (36)	4369 (61)
October	13	0 (0)	1 ( 8)	5 (38)	7 (54)	3872	0 (0)	440 (11)	1805 (47)	1627 (42)
November	15	0 (0)	3 (20)	5 (33)	7 (47)	3180	0 (0)	802 (25)	1702 (54)	676 (21)
December	8	0 (0)	2 (25)	6 (75)	0 ( 0)	2571	0 (0)	1506 (59)	945 (37)	120 ( 5)
<b>Time of last test during second surge</b>										
September	4	0 (0)	1 (25)	2 (50)	1 (25)	447	0 (0)	271 (61)	164 (37)	12 ( 3)
October	5	0 (0)	1 (20)	4 (80)	0 ( 0)	1194	0 (0)	440 (37)	593 (50)	161 (13)
November	11	0 (0)	3 (27)	4 (36)	4 (36)	3390	0 (0)	802 (24)	1728 (51)	860 (25)
December	52	0 (0)	2 ( 4)	16 (31)	34 (65)	11788	0 (0)	1506 (13)	4523 (38)	5759 (49)

Note: Data are number of people with row percentages shown in parentheses.

**Table S2. Number of tests per person during the second surge, among people tested in the first surge.**

	Degrees of freedom	Estimate	Standard error	p-value	LR test for inclusion of variable
Intercept	1	-7.4840	0.0600	<0.0001	
Exposed (i.e. positive test during surge 1)	1	-1.6339	0.1181	<0.0001	
Female sex	1	-0.0959	0.0162	<0.0001	
Age group 1: 0-5 years	1	-0.5501	0.0807		
Age group 2: 6-14 years	1	-0.0660	0.0648		
Age group 3: 15-24 years	1	0.3149	0.0561		
Age group 4: 25-34 years	1	0.1110	0.0556		
Age group 5: 35-44 years	1	0.0114	0.0559		
Age group 6: 45-54 years	1	0.0014	0.0556		
Age group 7: 55-64 years	1	-0.1355	0.0563		
Age group 8: 65-74 years	1	-0.4629	0.0620		
Age group 9: 75-84 years	1	-0.4086	0.0667		
Age group 10: 85+ years	0	ref	-	-	<0.0001, 9 d.f.
Test frequency group 1: 1-2 tests	1	-1.7539	0.0363		
Test frequency group 2: 3-5 tests	1	-0.4490	0.0299		
Test frequency group 3: 6-10 tests	1	-0.1755	0.0310		
Test frequency group 4: 11+	0	ref	-	-	<0.0001, 3 d.f.

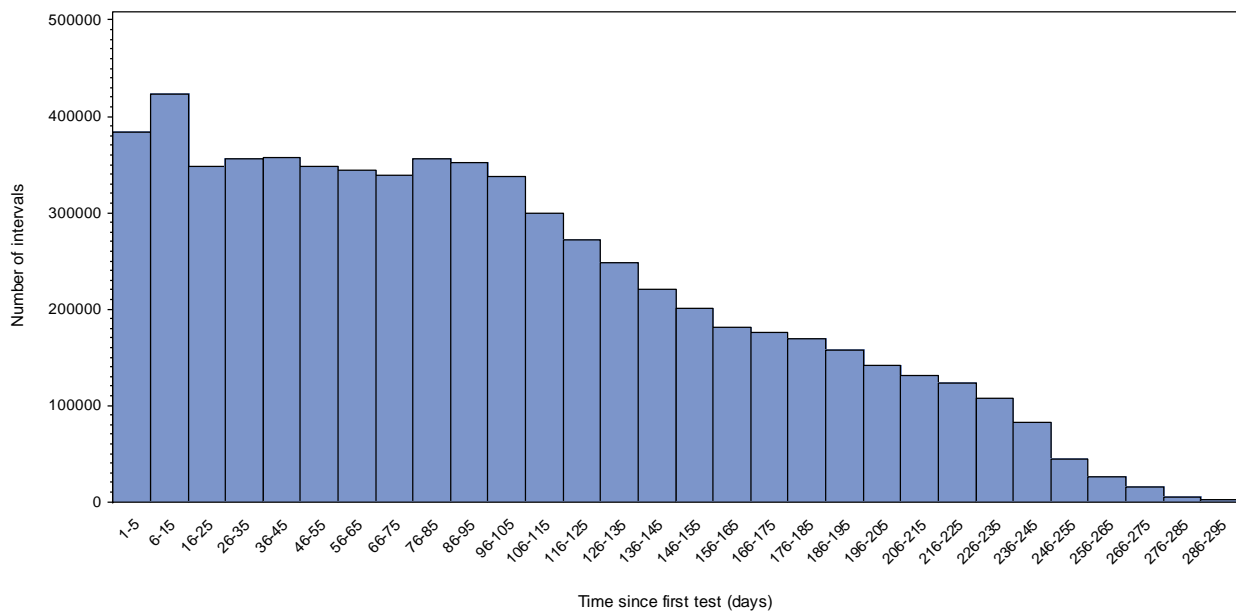
Note: Model parameters were estimated in a Poisson regression: generalized linear model, with a Poisson distribution and log link.

**Table S3a. Model parameters for main analysis: Reinfection during the second surge.**

	Degrees of freedom	Estimate	Standard error	p-value	LR test for inclusion of variable
Intercept	1	-9.9297	0.2520	<0.0001	
Exposed (i.e. positive test during surge 1)	1	-1.5512	0.0854	<0.0001	
Male sex	1	0.0916	0.0088	<0.0001	
Age group 1: 0-5 years	0	ref	-		<0.0001, 9 d.f.
Age group 2: 6-14 years	1	0.4871	0.0341		
Age group 3: 15-24 years	1	0.7826	0.0318		
Age group 4: 25-34 years	1	0.6261	0.0319		
Age group 5: 35-44 years	1	0.5043	0.0324		
Age group 6: 45-54 years	1	0.5211	0.0322		
Age group 7: 55-64 years	1	0.3778	0.0330		
Age group 8: 65-74 years	1	0.0791	0.0358		
Age group 9: 75-84 years	1	0.0849	0.0395		
Age group 10: 85+ years	1	0.4665	0.0470		<0.0001, 3 d.f.
Test frequency group 1: 1-2 tests	0	ref	-		
Test frequency group 2: 3-5 tests	1	1.3447	0.0123		
Test frequency group 3: 6-10 tests	1	1.6399	0.0142		
Test frequency group 4: 11+	1	1.7994	0.0244		
Start month: October*	1	-1.0642	0.6292		
Start month: September	1	0.9981	0.2503		
Start month: August	1	0.7907	0.2502		
Start month: July	1	0.4565	0.2503		
Start month: June	1	0.1644	0.2502		<0.0001, 8 d.f.
Start month: May	1	-0.0761	0.2502		
Start month: April	1	-0.2509	0.2503		
Start month: March	1	-0.4593	0.2526		
Start month: February	0	ref	-		

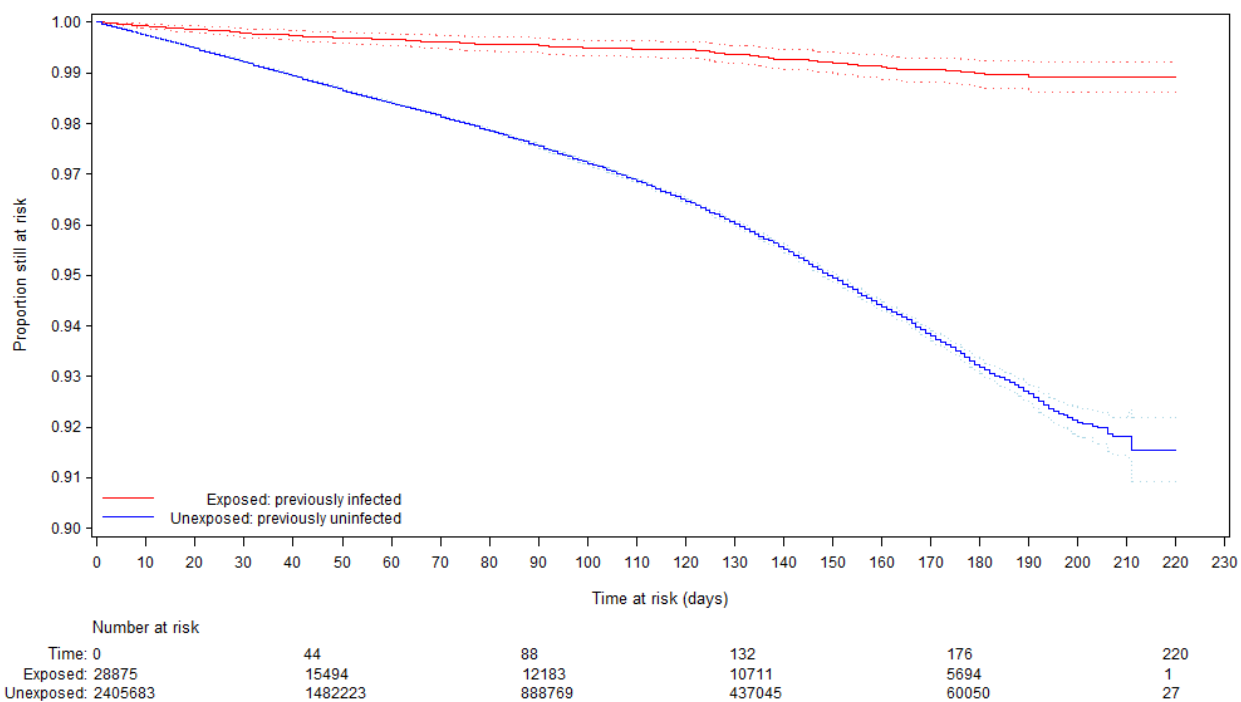
Notes: Model parameters were estimated in a Poisson regression: generalized linear model, with a Poisson distribution and log link. Start month indicates month of index test, i.e. the initial test that determines exposure status. \*A few participants had their index test during the first two days of October, with the start of follow-up 90 days later at the very end of December.

**Table S3b. Model parameters for the alternative cohort analysis: reinfection at least three months after first infection.**



**Figure S1. Time between testing**

Distribution of time from the first to repeat tests (showing data from 6,547,105 intervals contributed by 2,550,533 individuals).



**Figure S2. Kaplan-Meier curves of the time until (re)infection during follow-up**  
(log-rank  $p < 0.0001$ ).